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lentis obtusissimis; articulis inferioribus diametro 2–3-plo supremis multoties longioribus.

Semiavinia Bay, Arctic Asia. (Also at Whalefish Islands, Davis's Straits, and in the Arctic Ocean, lat. 76°, *Dr. Lyall.*)

50. Rivularia opaca: fronde (minori) vesiculosa difformi rigida opaca nigro-viridi; filis moniliformibus laxiusculis.

Loo Choo Islands.

51. Lyngbya atrovirens: cæspitibus longe fluitantibus atrovirentibus comosis; filis crassiusculis liberis glaucis densissime striatis; vagina crassa subopaca sæpe rugosa.

Loo Choo Islands.

52. Lyngbya effusa: cæspite effusa nigro-viridi; filis semiuncialibus tenuibus intricatis flexuosis glaucis; vagina angusta lævi.

Loo Choo Islands. An obscure production.

53. Lyngbya atropurpurea: cæspite atropurpurea comosa; filis tenuissimis fluitantibus strictiusculis violaceis, striis inconspicuis. (Harv. Alg. Ins. Amic. no. 118.)

Bonin Islands; on corals. (Also at the Friendly Islands.)

54. Chroolepus Chinensis: majuscula, rupestris; filis in cæspite (2-unc.) tomentosa luteo-viridi siccitate pallide glaucescenti intertextis decumbentibus vage ramosis; ramis horizontaliter patentibus recurvis sæpius secundis; ramulis paucis multisve patentibus; sporidiis lateralibus sparsis; articulis diametro duplo longioribus.

Hong Kong; on damp rocks in the mountains.

Four hundred and seventy-first meeting.

November 9, 1859. — Stated Meeting.

The President in the chair.

The Corresponding Secretary read several letters relative to the exchanges of the Academy.

He also read a "Note upon the Allanite found at East Bradford, Pennsylvania, by William Sharswood, A. M."

Professor Gabriel Valentin, of Berne, Switzerland, was elected a Foreign Honorary Member in Class II. Section 2 (Botany).

The following Associate Fellows were elected: —

Professor George C. Swallow of Columbia, Missouri, in Class II. Section 1 (Geology, Mineralogy, and Physics of the Globe).

Hon. Samuel G. Arnold, of Providence, in Class III. Section 3 (Political Economy and History).

Edward B. Hunt, U. S. A., in Class I. Section 3 (Physics and Chemistry).

The following Fellows were elected: —

Calvin Ellis, M. D., in Class II. Section 4 (Medicine and Surgery).

Theodore Lyman, in Class II. Section 3 (Zoölogy and Physiology).

E. S. Ritchie, in Class I. Section 3 (Physics and Chemistry).

Professor Lovering inquired whether the following extracts from Winthrop's History of New England do not indicate the appearance of the Aurora in this country at a much earlier date than that assigned to it in Holmes's Annals: —

> "About midnight three men, coming in a boat to Boston, saw two lights arise out of the water near the north point of the town cove, in form like a man, and went at a small distance to the town, and to the south point, and there vanished away." "The like was seen by many, a week after."

In the second case: —

> "A light, like the moon, arose about the northeast point in Boston, and met the former at Nottles Island, and there they closed in one, and then parted, and closed and parted divers times, and so went over the hill in the island and vanished. Sometimes they shot out flames, and sometimes sparkles."

This was on the 11th and 18th of April, 1643.

Professor Lovering, in behalf of the Committee of Publication, made the following report in regard to the printing of Part I. of Volume II. of the Old Series of Memoirs, ordered by the Academy at the last annual meeting.

The Committee had directed 200 copies of this Part to be printed. They had also found it necessary to print 200 copies of Judge Davis's Eulogy upon Washington, belonging to the second part of the same volume. This republication will enable the Academy at once to realize 92 complete sets of the First Series of Memoirs; and the reprint hereafter, when the necessity arises, of another small portion, will make complete 100 more sets. For there are in the possession of the Academy 237 copies of Volume I. There are only 3 copies of Volume II. There are 18 additional copies of Part II. of that volume. There are also 100 additional copies of Part II., with the exception of Judge Davis's Eulogy on Washington. There are besides 68 extra copies of Plate I., 27 extra copies of Plate II.; and the stone on which the illustration of Dighton Rock is drawn is also in possession of the Academy. Of Volume III. there are 57 complete copies. Then there are 64 separate copies of Part I. and 35 of Part II. Of Volume IV. there are 245 complete copies; and, in addition, 3 of Part I. and 78 of Part II.

As the 24 additional pages to be printed, and the supply of three woodcuts and a lithographed plate, have made the cost of republication exceed by $ 50 the appropriation for this special purpose ($ 200), the committee recommend that a subscription paper be opened to members of the Academy for complete sets of the Old Series of Memoirs, at $ 3 a volume, or $ 12 the set. If 20 sets were purchased, the cost of republication would be repaid to the Academy, and 72 complete sets would remain immediately available.

Dr. Jenks gave an account of the organization of a literary and scientific society at Shanghae.

Dr. J. B. S. Jackson exhibited a portion of a glass tube which was accidentally broken while drawing a sponge through to clean it; one piece of which exhibited a very regular spiral crack running from end to end.

Professor W. B. Rogers said he thought the direction of the crack might result from an equality between the cohesive attraction of the particles in a transverse and longitudinal direction, causing the line of fracture to follow the diagonal of these forces.

Professor Lovering suggested whether the nodal lines of acoustic vibration had anything to do with the phenomenon.

Professor Peirce made an elaborate communication on the tides.

Professor W. B. Rogers gave an account of some experiments which he had been making on the phenomena of subjective vision, to settle the question whether the two eyes combined successively the different points of an object, as Brewster supposed, or obtained an instantaneous recognition of all parts at the same moment.

Mr. F. H. Storer read by title a " Memoir on the Alloys of Copper and Zinc."

He also presented the following communication : —

On the Detection of Chromium in Presence of Iron.

It is customary, in the methods of analysis now most commonly employed in laboratories of instruction, to rely upon the solvent action which the caustic alkalies exert upon hydrated sesquioxide of chromium as a means of separating this base from the oxides closely allied to it. It is well known, however, and the experiments of Northcote and Church* have determined the fact quantitatively, that when a small amount of sesquioxide of chromium is accompanied by a large quantity of the oxides of manganese, cobalt, nickel, or of sesquioxide of iron, it ceases to be soluble in the alkalies. From the frequency of its occurrence, as well as from the fact that it has the power of concealing a larger amount of chromium than either of the other bases which have been mentioned, the sesquioxide of iron in particular gives rise to much inconvenience in practice. It is a constant source of annoyance to beginners, who almost invariably fail to detect the presence of chromium in solutions containing it given them for analysis, if these at the same time contain iron also. In this case it may be detected, it is true, by fusing the mixed precipitate of oxide of iron and of chromium with nitrate of potash and carbonate of soda, and examining the aqueous solution of the mass obtained for chromic acid; but the student seldom applies this test, unless specially directed to do so. The operation is troublesome, since it necessitates the employment of a special set of tools, and occupies considerable time. It is as a rule distasteful to the student, and is rarely resorted to even by experienced analysts, unless the color of the solution, a preliminary blowpipe test, or some incidental observation, has already indicated the probable presence of chromium in the substance under examination.

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* Qu. J. Chem. Soc, VI. 53.

It is obvious, that if the chromium in the mixed precipitate could be oxidized in the wet way by some simple and rapid method, it would not only be more readily detected in any case, but the chances of overlooking it altogether — an event now so liable to occur — would be materially lessened.

Frommherz * long ago noticed that chromic acid is formed when an aqueous solution of a salt of chromium is treated with a solution of permanganate of potash, — a fact which has since been corroborated by Reynoso,† and still more recently by Cloez and Guignet.‡ Reynoso has suggested, moreover, that this reaction may be employed for the detection of chromium, especially if the chromic acid formed be subsequently converted into Barreswil's perchromic acid.

Chancel,§ on the other hand, has observed that chromic acid is formed when sesquioxide of chromium is heated with solution of caustic potash in presence of peroxide of lead; as may be shown by acidifying the filtrate from this mixture with acetic acid, chromate of lead being precipitated. He has also proposed || that this reaction shall be used as a test for the detection of chromium.

After a number of experiments upon the subject, I have satisfied myself that peroxide of lead is as good an agent as any at our disposal, if it is not the best, for effecting the oxidation of sesquioxide of chromium by the wet way, while the formation of perchromic acid is unquestionably the most delicate and characteristic reaction for chromic acid which we possess. This note, therefore, must be considered as being merely supplementary to the statements of Chancel and Reynoso.

Besides the observations of these chemists are those of Balard,¶

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* Schweigger's Journal f. Ch. u. Phys., 1824, XLI. 281.

† Ann. Ch. et Phys., 1851, (3), XXXIII. 324.

‡ Comptes Rendus, XLVII. 712.

§ Comptes Rendus, XLIII. 928.

|| *Loc. cit*, and Précis d'Analyse Chimique Qualitative, par Gerhardt et Chancel, (Paris, 1855,) pp. 112, 289.

¶ Ann. Ch. et Phys. (2), LVII. 266.

that oxide of chromium is immediately changed to chromic acid when treated with a solution of hypochlorous acid; and of Carney,* who has found that chromic acid is produced when a galvanic current is caused to flow through a dilute solution of caustic alkali in which sesquioxide of chromium, even that which has been ignited, is suspended.

For my own part, I have observed that sesquioxide of chromium may be converted into chromic acid in the wet way by the agency of several substances besides those already mentioned, and that the presence of free alkali, so far from being necessary, as has been implied by previous observers, with the exception perhaps of Frommherz, is not by any means essential in most instances to the success of the operation, oxidation occurring very readily in several cases in strongly acid solutions.

A dilute solution of chrome alum — which by experiment was ascertained to contain no chromic acid — was acidulated with sulphuric acid, a little peroxide of lead was added, and the whole boiled; on filtering, the solution was found to be of a yellow color, and readily afforded the reaction of chromic acid when tested with dilute solution of peroxide of hydrogen, viz. a magnificent blue coloration due to the formation of perchromic acid.

A solution of permanganate of potash, acidulated with dilute sulphuric acid, being substituted for the peroxide of lead in the preceding experiment, produced a similar result. Peroxide of manganese also replaces perfectly the peroxide of lead in this experiment.

It is not even necessary that these mixtures should be heated. Dilute solution of chrome alum, acidulated with sulphuric acid, and mixed with a small portion of peroxide of lead, having been allowed to stand in the cold, was found to contain traces of chromic acid at the end of half an hour; after standing eighteen hours, a considerable quantity of chromic acid had formed.

A similar solution, in which peroxide of manganese was used instead of the peroxide of lead, gave a fine reaction of chromic acid at the end of eighteen hours.

A quantity of solution of permanganate of potash, acidulated with dilute sulphuric acid, having been added to a dilute solution of chrome alum, also acidulated with sulphuric acid, retained its purple color after having stood in the cold during twenty-four hours; at the end of this time, bits of paper were introduced in order to destroy this color, after effecting which, the solution was tested: it contained no inconsiderable amount of chromic acid.

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* Proceedings of Boston Society of Natural History, VI. 409.

The foregoing experiments were all repeated, with almost absolutely identical results, with solutions prepared by dissolving chemically pure hydrated sesquioxide of chromium in dilute sulphuric acid. The formation of chromic acid in the cold may have been a little less rapid in this case than in the experiments with chrome alum; the mixture containing peroxide of lead, however, afforded an abundance of it when tested after having stood two hours, and still more at the end of twenty-four hours. That containing peroxide of manganese also gave a fine reaction of chromic acid after standing twenty-four hours. The trial with acidulated permanganate of potash was not tested until the purple color of the solution had disappeared; this was found to have occurred after the expiration of forty-eight hours; the solution was then yellow, and afforded the reaction of chromic acid.

Sesquioxide of chromium, dissolved in dilute nitric acid, is also converted into chromic acid when the solution is boiled with peroxide of lead, with peroxide of manganese, or with a solution of permanganate of potash acidified with dilute nitric acid; minium produced the same result, though somewhat more slowly. This action is much less rapid in the cold; the sample tested with permanganate of potash contained chromic acid after having stood during twenty-four hours; the solution to which peroxide of lead had been added assumed a decided yellow color, and afforded the reaction of chromic acid after standing three or four days; but the portion which had been mixed with black oxide of manganese gave no indication of chromic acid when examined at the end of the fifth day.

When dilute chlorhydric acid is used, instead of the sulphuric or nitric acids of the preceding experiments, similar results are obtained; at least with peroxide of manganese and with solution of chameleon mineral, both in the cold and when heated. With peroxide of lead, however, the results are less satisfactory. I have not been able to obtain any decisive indication of the formation of chromic acid in this experiment, but at the same time am not sure that minute traces of it may not have been present. The conversion of the peroxide into chloride of lead apparently interferes with the production of chromic acid.

In concentrated sulphuric acid sesquioxide of chromium is evidently slowly converted into chromic acid by the action of peroxide of lead, even in the cold, since the solution becomes yellow after standing eighteen or twenty-four hours. This action is very rapid if the mixture be heated, a fine yellow solution being obtained at once. I have, nevertheless, found it somewhat difficult to prove the presence of chromic acid in this solution, since it appears to be decomposed when diluted with water.

With peroxide of manganese, a yellowish solution is also readily obtained by boiling. In the cold, no reaction could be perceived at the end of five days.

When a solution of sesquioxide of chromium in concentrated sulphuric acid is boiled with a small quantity of chlorate of potash, chromic acid is formed. With very dilute sulphuric acid, this does not at once occur; but after boiling for some time, the acid becomes more concentrated, and a portion of the chromium is then oxidized. Nitrate of potash produces no similar result when used instead of the chlorate in this experiment.

When dissolved in concentrated nitric acid, sesquioxide of chromium is slowly oxidized by peroxide of lead in the cold, abundant indications of it having been obtained at the end of eighteen hours. The reaction occurs at once if the acid be boiled. Minium also, when boiled with solution of sesquioxide of chromium in concentrated nitric acid, rapidly converts it into chromic acid. With peroxide of manganese, no chromic acid was obtained, either by boiling or after standing in the cold during a week. When a solution of sesquioxide of chromium in concentrated nitric acid is boiled with a small quantity of chlorate of potash, the chromium is rapidly and completely converted into chromic acid. With very dilute nitric acid this does not occur. Nitrate of potash having been substituted for the chlorate in this experiment, no chromic acid was formed.

With concentrated chlorhydric acid and the above-mentioned oxidizing agents, only negative results were obtained. As a general rule, it is not easy to oxidize sesquioxide of chromium in the presence of free chlorhydric acid, — a fact which accords with the well-known reducing action exerted by this acid upon solutions of chromic acid or of its salts.*

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* *Vid.* Rose, Handbuch der analytischen Chemie, I. 355 (Braunschweig, 1851).

When dissolved, or merely suspended in dilute aqueous solutions of the fixed alkalies, sesquioxide of chromium is readily converted, even in the cold, into chromic acid, by the action of the peroxide of lead and of manganese, by permanganate of potash, and with peculiar rapidity and completeness by Bromine. The application of heat favors the reaction in each of these instances. Iodine, also, at least when the mixture is heated, appears to behave like bromine; the oxidation is, however, much less rapid. Chromic acid is also formed when red oxide of mercury or hypochlorite of lime is heated with a mixture of sesquioxide of chromium and solution of caustic alkali; none was obtained by the action of stannic or of arsenic acid, nor can minium be used in place of peroxide of lead, since it does not appear to exert any oxidizing action upon sesquioxide of chromium when in presence of the alkalies.

When mixed with ammonia, oxide of chromium is readily oxidized by peroxide of lead, peroxide of manganese, or by solution of chameleon, the free alkali of which has been neutralized, if heat be applied. A similar oxidation also occurs, though slowly, in the cold. With bromine no chromic acid was obtained, — a result not at all surprising, in view of the violent reaction which occurs when this substance is mixed with ammonia.

In studying the reactions which have just been described, I was met at the outset by the difficulty that none of the tests for chromic acid — viz. precipitation of sparingly soluble chromates of the metallic oxides — which are in common use were sufficiently delicate for the purpose. Indeed, besides the yellow color of solutions of the chromates, which is of course far from being characteristic, there is no test for traces of this acid which is susceptible of rapid and general application, excepting the formation of perchromic acid by means of peroxide of hydrogen. Having, like Reynoso, been compelled to resort to this reaction, I have found it incomparably more sensitive and characteristic than any of the other tests for chromic acid. Taken in connection with the yellow color of solutions containing chromates, it affords a test of remarkable delicacy. It depends, in brief, upon the fact, that when a solution containing chromic acid is poured into a *dilute* * solution of peroxide of hydrogen, perchromic acid is formed; this imparts a beautiful, though exceedingly evanescent, blue color to the solution. The perchromic acid is soluble in ether, which removes it from its solution in water without injuring its color, which indeed disappears far less rapidly from the ethereal than from the aqueous solution.

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* It is of the first importance that the solutions used should be dilute, since no perchromic acid is formed in concentrated solutions; or if formed, it is decomposed again instantly.

The details of the process to be followed in applying this test may be found in Barreswil's Memoir upon Perchromic Acid.*

I have obtained satisfactory results by operating as follows. A solution of impure peroxide of hydrogen is prepared by triturating peroxide of barium with water in a porcelain mortar, and pouring the thin paste obtained by small portions into a quantity of common chlorhydric acid, which has previously been diluted with four or five parts of water, the latter being agitated meanwhile with a glass rod. The solution thus obtained may be kept for a considerable time without undergoing change. I have not, for that matter, noticed any decomposition in those with which I have operated.

A piece of peroxide of barium as large as a pea is more than sufficient to prepare 150 cubic centimetres of the solution. In testing, some six or eight cubic centimetres of the solution of peroxide of hydrogen are to be placed in a narrow test-tube, and covered with a layer of ether about half a centimetre in thickness. The solution suspected to contain chromic acid is now to be poured little by little into the solution of peroxide of hydrogen, the tube which contains the latter being closed with the thumb, and gently inverted after each addition, so that the ether may dissolve the perchromic acid as fast as it forms. All violent agitation of the mixture is to be avoided, since it tends to hasten the destruction of the blue color. The result of the test can hardly be deemed satisfactory, unless a blue ethereal solution is obtained, for many of the salts of chromium impart a bluish-purple color to their aqueous solutions. Since this color is persistent, however, it cannot be confounded in any case with the fugitive blue of perchromic acid, although it might at times conceal the latter so long as it remained dissolved in the water; for the rest, it is absolutely insoluble in ether.

One or two experiments regarding the delicacy of the reaction may be mentioned in this connection. A solution containing one part of normal chromate of potash in 20,000 parts of water afforded a perfectly distinct blue ethereal solution of perchromic acid, when tested with peroxide of hydrogen as above described. A solution of one part chromate of potash in 30,000 parts of water also gave a distinct reaction, though the blue color was less deep than in the preceding experiment. With 40,000 parts of water the reaction was faint, though still discernible; as much so, perhaps, as the yellow of the aqueous solution of the chromate.

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* Ann. Ch. et Phys. (3), XX. 364.

I have also detected, by means of this test, the presence of chromic acid in the aqueous solution of a bead, of ordinary size, obtained by fusing sesquioxide of chromium with borax in a loop of platinum wire in the oxidizing flame of the blowpipe. Plattner * had already supposed that the yellowish color, which compounds of chromium impart to borax in the oxidizing flame, was due to formation of chromic acid. It is doubtful, however, whether the fact has been previously experimentally proved.

Several experiments have also been made in order to ascertain whether the presence of peroxide of iron would interfere with the oxidation of the sesquioxide of chromium. Weighed portions of protosulphate of iron were boiled with nitric acid in order to oxidize the iron, and mixed with weighed portions of chrome alum; the solutions were then treated with a slight excess of caustic ammonia, and boiled. After washing the precipitates formed, they were subjected to the action of oxidizing agents.

I have operated upon mixtures composed of: —

Grammes.				Grammes.		Per cent.
	No. 1.					
3.00	$FeO\,SO_3 + 7\,aq$		$FeO_{1\frac{1}{2}}$	0.8633	or	84.81
+		=				
1.00	$KO\,SO_3;\ Cr_2O_3,\ 3\,SO_3 + 24\,aq$		Cr_2O_3	0.1546	or	15.19
	No. 2.					
3.00	$FeO\,SO_3 + 7\,aq$		$FeO_{1\frac{1}{2}}$	0.8633	or	91.78
+		=				
0.50	$KO\,SO_3;\ Cr_2O_3,\ 3\,SO_3 + 24\,aq$		Cr_2O_3	0.0773	or	8.22
	No. 3.					
5.00	$FeO\,SO_3 + 7\,aq$		$FeO_{1\frac{1}{2}}$	1.4389	or	97.38
+		=				
0.25	$KO\,SO_3;\ Cr_2O_3,\ 3\,SO_3 + 24\,aq$		Cr_2O_3	0.0387	or	2.62

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* Probirkunst mit dem Loethrohre, von Plattner, (Leipzig, 1853,) S. 144.

No. 4.

Grammes.				Grammes.	Per cent.
10.00	$FeO\,SO_3 + 7\,aq$	=	$FeO_{1\frac{1}{2}}$	2.8777	or 98.73
+					
0.25	$KO\,SO_3;\ Cr_2O_3,\ 3\,SO_3 + 24\,aq$		Cr_2O_3	0.0387	or 1.27

No. 5.

Grammes.				Grammes.	Per cent.
20.00	$FeO\,SO_3 + 7\,aq$	=	$FeO_{1\frac{1}{2}}$	5.7554	or 99.33
+					
0.25	$KO\,SO_3;\ Cr_2O_3,\ 3\,SO_3 + 24\,aq$		Cr_2O_3	0.0387	or 0.67

Portions of the precipitate produced by ammonia in each of these solutions were dissolved in chlorhydric acid, and a part of this solution was treated with an excess of cold potash lye of sp. gr. = 1.305; an excess of caustic soda of sp. gr. = 1.07 being added to another portion. After standing in the cold, out of contact with the air, during eighteen hours, the alkaline mixtures were filtered, and the filtrates thoroughly boiled. No precipitate of sesquioxide of chromium was produced in any of them, nor did these filtrates afford any chromic acid when boiled with peroxide of lead.

Other portions of the moist original precipitates were dissolved in chlorhydric acid, and these solutions treated with a slight excess of dilute caustic soda. A small quantity of peroxide of lead was now added to the mixture, and the whole thoroughly boiled during two or three minutes. On filtering, yellow-colored solutions were obtained in every instance, and on testing these with peroxide of hydrogen the characteristic reaction of chromic acid was very distinct in each.

The oxide of chromium in other portions of all of the original precipitates was also readily oxidized by boiling them with bromine in presence of free alkali, as well as by dissolving them in concentrated nitric acid, and boiling this solution with chlorate of potash. The presence of chromium was, moreover, readily detected in Nos. 1 and 2 by boiling a mixture of precipitate and alkali with peroxide of manganese, or with permanganate of potash; but as these substances are evidently less conveniently applied than the others which I have mentioned, no further experiments were made with them.

It should perhaps be stated, that the experiments upon the precipitate from mixture No. 5 were made upon portions of it weighing two or three grammes, the entire weight of the moist precipitate being something more than a hundred grammes.

Among the various agents capable of oxidizing oxide of chromium when in presence of sesquioxide of iron, it is not at first sight easy to decide which one should be preferred to the others for common use. Bromine in presence of the alkalies appears to be the most powerful of them, but since the acid solution of peroxide of hydrogen, which is used in testing, would react upon any bromide which might have been formed in the alkaline solution, bromine would be liberated, and, by imparting its color to the ether, would obscure the reaction. A similar objection applies of course to iodine. This difficulty is easily overcome by neutralizing the alkali with nitric acid, and boiling for a few minutes to expel the bromine: an objection to this process, however, is the fact that the solution is considerably diluted thereby.

Chlorate of potash, with concentrated nitric acid, is in some respects a very convenient agent: objections to it are, that some of the products of the decomposition of the chlorate which remain in the solution, appear to interfere with the formation of perchromic acid; moreover, if any nitrate of chromium remain unoxidized in the solution, it will impart a bluish-purple tint to the aqueous solution of peroxide of hydrogen, which, though insoluble in ether, often interferes very materially with the detection of the color of perchromic acid, if only traces of the latter are present. This remark applies to any process of oxidation in which nitric acid is employed. Both of these difficulties can generally be avoided by diluting the nitric acid solution with water, and using a quantity of ether somewhat larger than is usually necessary. In any case where hyponitric acid is generated, it dissolves in the ether, and may conceal the blue color of perchromic acid.

Black oxide of manganese is not only a less energetic oxidizing agent than peroxide of lead, but the chromate formed in its presence does not color the solution so strongly. The latter remark applies also to permanganate of potash, another objection to which is the necessity of destroying its own color whenever it has been used in excess, before testing for chromic acid.

On the other hand, the reagent of Chancel, peroxide of lead, is capable, as I have shown, of oxidizing sesquioxide of chromium, even when in presence of an enormous excess of peroxide of iron. It has none of the disadvantages of the other substances to which allusion has been made, and is especially to be preferred, since the chromate formed in its presence imparts an intense yellow color to the alkaline solution.

It must be remembered, however, that this coloration, although a very delicate, is by no means a *characteristic* test,* and that the presence of even considerable quantities of chromic acid cannot be detected in the solution by the methods in common use. For example, the yellow-colored filtrate obtained after having boiled a portion of the precipitate from mixture No. 3 (which contained more than 2.5 per cent of sesquioxide of chromium) with a solution of caustic soda and some peroxide of lead, was slightly acidified with acetic acid, care being taken not to dilute the solution unnecessarily. No precipitate was formed even after the lapse of forty-eight hours; the solution still retained its yellow color, however, and afforded a fine blue ethereal solution when treated with peroxide of hydrogen. Even in experiment No. 1, the yellow alkaline solution of chromate of lead gave no immediate precipitate when neutralized with acetic acid, nor did any appear until after the lapse of considerable time.

When concentrated alkaline solutions are used in conjunction with the peroxide of lead, it is best to acidify them, before testing with peroxide of hydrogen, since the reaction might otherwise be disturbed. This is not necessary, however, when dilute alkali is used.

The methods of oxidizing chromium which have been discussed in this article are of course applicable to a great variety of cases. I have only specially treated of the one in which this oxide is concealed by an excess of peroxide of iron, since an improvement upon the ordinary processes seems to be peculiarly needed in this instance. It will be found, however, that, with the exception of the blowpipe tests, none of the methods for the detection of chromium which are now in use can be compared with the one herein proposed.

An apparent objection to this process is the doubt which suggests itself whether peroxide of hydrogen may not be capable, under some circumstances, of producing perchromic acid when mixed with solutions, not only of chromic acid, but also of simple sesquioxide of chromium. It is indeed somewhat strange that this should not be the case. I have not, however, been able to effect such transformation, although I have made a large number of experiments with solutions and mixtures of the sesquioxide in the mineral acids and in alkalies, under the most varied conditions as regards their temperature and state of concentration. In short, I have seen nothing which militates in the least against the accuracy of the test.

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* It is probable that by the use of the prism, as proposed by Gladstone (Qu. J. Ch. Soc., X. 79), these colored solutions might be satisfactorily tested for chromic acid.

It is true that, when peroxide of barium is itself added to a solution of sesquioxide of chromium in caustic alkali, and the whole is boiled, a certain quantity of chromic acid is obtained. I have not been able to procure any, however, by operating in the cold.

With caustic ammonia and peroxide of barium, the chromium is gradually converted into a violet ammonia-chromium base in the cold. On boiling the original mixture, a quantity of chromate of baryta is formed. But when in solution in acids, sesquioxide of chromium does not appear to be converted into chromic acid by the action of peroxide of barium, either in the cold or when heated.

Four hundred and seventy-second meeting.

November 22, 1859. — MONTHLY MEETING.

The PRESIDENT in the chair.

The Corresponding Secretary read letters of acceptance from the Hon. S. G. Arnold of Providence, and Captain E. B. Hunt, United States Engineer, who were elected Fellows at the last stated meeting.

Mr. C. B. Elliott read a paper upon

The Influence of Legislation on Registration in Massachusetts.

The results in the following table are deductions from data furnished by the Annual Reports of the Secretary of the Commonwealth, relating to the registry and return of births, deaths, and marriages in Massachusetts for the seven years from May 1st, 1841, to April 30th, 1848 (inclusive); for the nine years from January 1st, 1849, to December 31st, 1857 (inclusive); and from data furnished by the national enumerations of the population of the State made in the years 1840 and 1850, and the State enumeration of 1855.

The table exhibits the ratios of the births, the deaths, and the marriages, registered in each of the years above mentioned, to the population, estimated for the middle of each year. Also, the average of each class of these ratios for the *two* years immediately preceding the op-